Appendix J
GEOGRAPHICALLY BASED VULNERABILITY ANALYSIS OF WETLANDS WITHIN THE KISSIMMEE BASIN WATER SUPPLY PLANNING AREA

Larry Pearson, AICP
Orlando Service Center

A geographically based vulnerability analysis was performed to determine which wetlands in the Kissimmee Basin (KB) Planning Area were the most and least vulnerable to harm from projected increases in ground water withdrawals from 1995 to 2020. This analysis was done in support of the KB Water Supply Plan effort and was undertaken to evaluate the effects of the projected drawdown on the wetlands resource protection criteria developed under the plan. Results of the analysis will be used in the decision making process on water supply options and to focus the work of more detailed wetland studies in the future.

The Wetlands Vulnerability Analysis (WVA) is an approach taken as alternative to specifying a fixed numeric criteria for a given wetland. Instead, the WVA approaches the issue of potential wetland harm by assessing those factors that influence the change in water levels within the aquifer controlling wetland water levels. These factors include: the ability of water to move vertically though the intermediate (Miocene) unit, location of wetland features, and the change in potentiometric head within the Upper Floridan Aquifer System due to changes in water use from 1995 to 2020. This work is designed to be a planning level analysis and is not intended to identify specific wetland impacts.

The geographic analysis technique used was first developed by Dr. Ian McHarg in the 1970s. This technique has been substantially facilitated by Geographic Information System (GIS) software. The technique involves generating a series of digital maps with each map representing a separate factor used in the analysis. Each map is divided into a series of rectangular grids with each assigned a score based upon a weighting criteria. The scores are summed and averaged and displayed as resultant map. For this analysis, the technique was carried out in three general steps. These steps included: 1) assigning numeric scores to each gridded variable; 2) applying a weighted score system; and 3) combining the selected variable grids.

DESCRIPTION OF SELECTED VARIABLES

Three variables were selected for this analysis. These included thickness of the intermediate (Miocene) unit, location of wetland features, and the change in potentiometric head within the Upper Floridan Aquifer System due to changes in water use from 1995 to 2020.

The thickness of the confining Miocene unit was used to represent the factor controlling potential vertical water movement. The confining unit thickness is directly related to, and is the best defined, of the variables controlling vertical movement. Using confining unit thickness in the analysis assumes that the other variables influencing the rate of vertical water movement, such as hydraulic conductivity, are uniform.

Information collected to define the thickness of the confining unit was obtained from the U.S. Geological Survey (USGS) and from District records and was the same information used in the construction of the MODFLOW models developed for the KB Water Supply Plan effort. **Figure J-1** shows an isopach map of the confining unit thickness in and surrounding the planning basin.

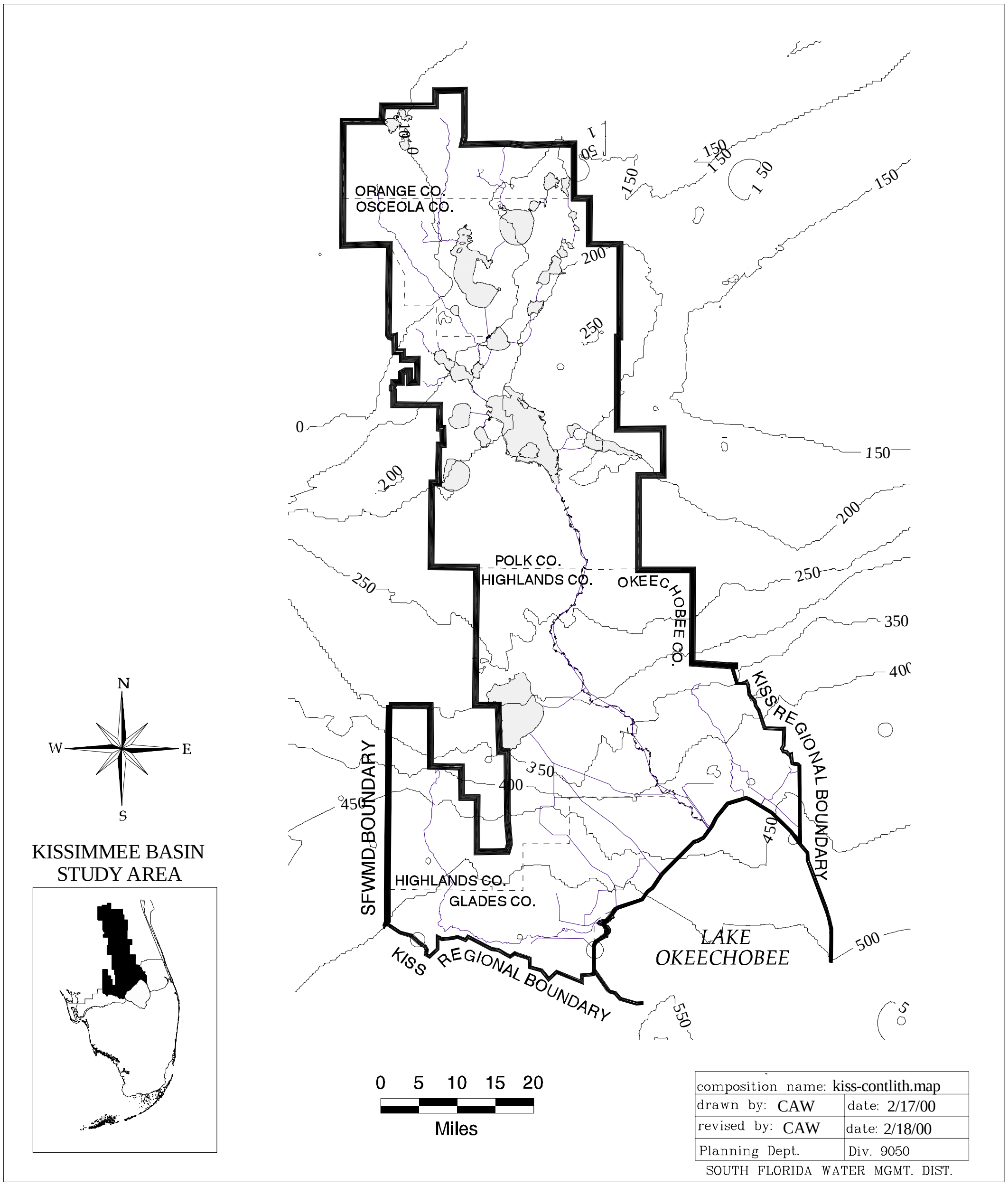

Figure J-1. Thickness of Confining Units in the Kissimmee Basin Planning Area.

The change in potentiometric head in the Floridan aquifer is used as the second factor in the analysis. The water level changes used are from the predictive results of the modeling simulation conducted under the planning effort. These water levels represent the change in water levels (drawdown) within the Floridan Aquifer System as a result of changes in withdrawals from 1995 to 2020 under average conditions. **Figure J-2** shows the projected change in Floridan aquifer levels for average conditions from 1995 to 2020.

The third variable selected for the analysis was wetland locations. The National Wetland Inventory, 1988 (NWI) was used as the base information for identification of the location of existing wetlands. The NWI coverage used in this analysis was combined in a previous analysis with the 1995 Land Use/Land Cover coverage to remove wetlands that have been lost to the effects of urbanization. Although the use of a wetlands coverage is not necessary in defining regions susceptible to transmission of Floridan aquifer drawdown, it is used in this analysis as a filter to eliminate areas where wetlands do not exist. **Figure J-3** shows the wetland coverage used for the analysis.

ASSIGNMENT OF VALUES TO THE THREE INPUT VARIABLES

The first step in the vulnerability analysis was to translate the data sets for each of the three input variables (layers) used in the study to a format of geographically referenced grids. The gridding process subdivided each layer into equally spaced cells of 1,131 feet by 1,131 feet. Each of the grid cells were assigned numeric scores based on the three identified variables describing the differing hydrologic characteristics. For example, if the average thickness of the confining unit was 100 feet at the georeferenced location of a grid cell, that cell would be assigned a value of 100. The same would be true for the change in water levels of the Floridan aquifer. In the case of identified wetlands, the area within a cell had to be predominately wetlands to be given a score.

WEIGHTED SCORING OF THE THREE VARIABLES

The second step in the process was to weight the three variables according to their estimated effect on the output variable. **Table J-1** describes the weighting scores applied to each of the variables. The wetland location layer was assigned a 0 for no wetlands and a 10 if the grid was cell was predominantly wetlands. If there were no wetlands in a grid, the likelihood of wetland harm would be zero. The range of scores for wetlands were purposely set to one-half that of the other factors to reduce the influence of that variable on the resultant scores. These scores assigned to each layer were based upon professional judgement and a limited amount of reference material. **Figures J-4**, **J-5**, and **J-6** show the resultant weighted scoring.

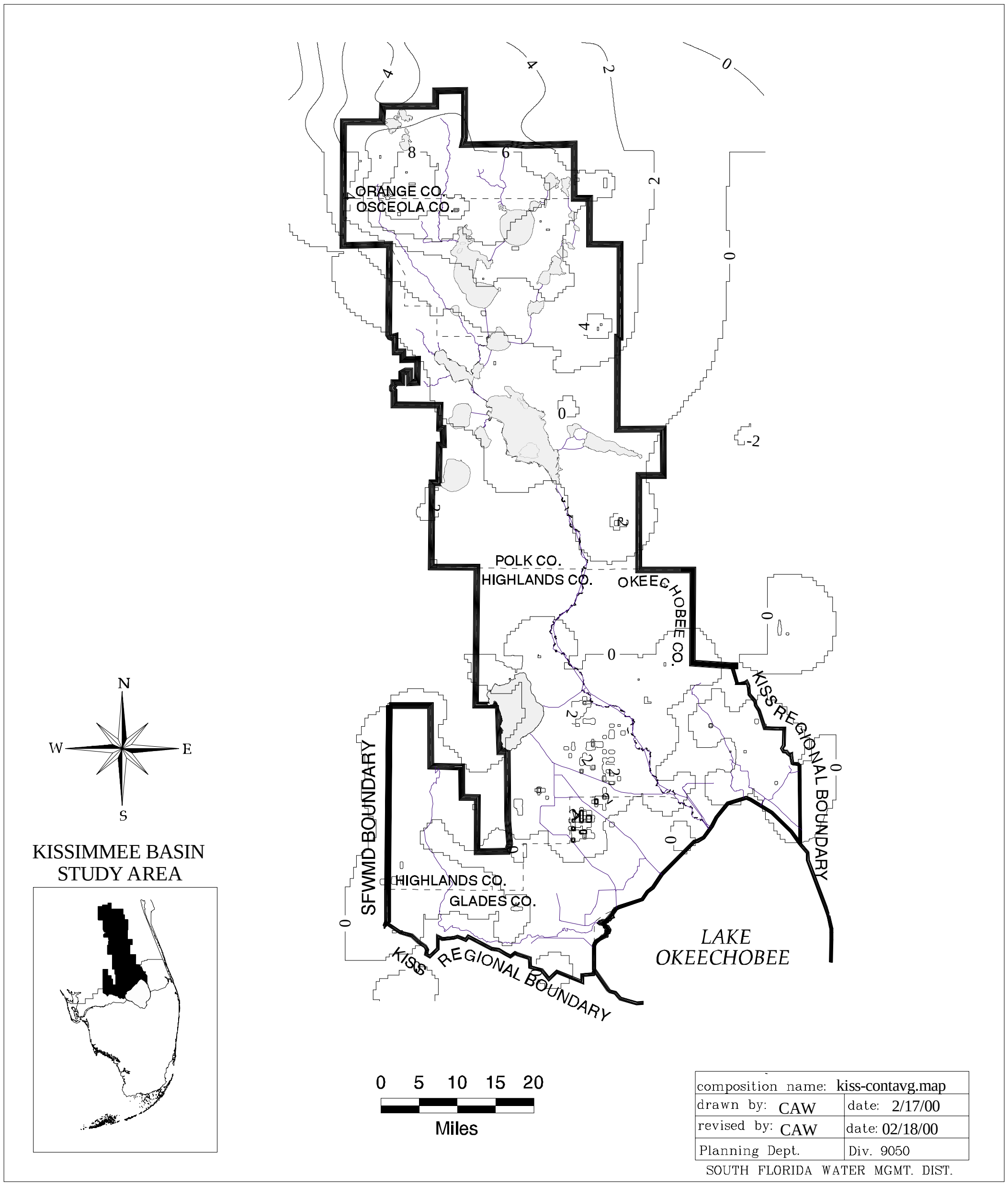

Figure J-2. Change in Upper Floridan Water Levels, 1995 to 2020.

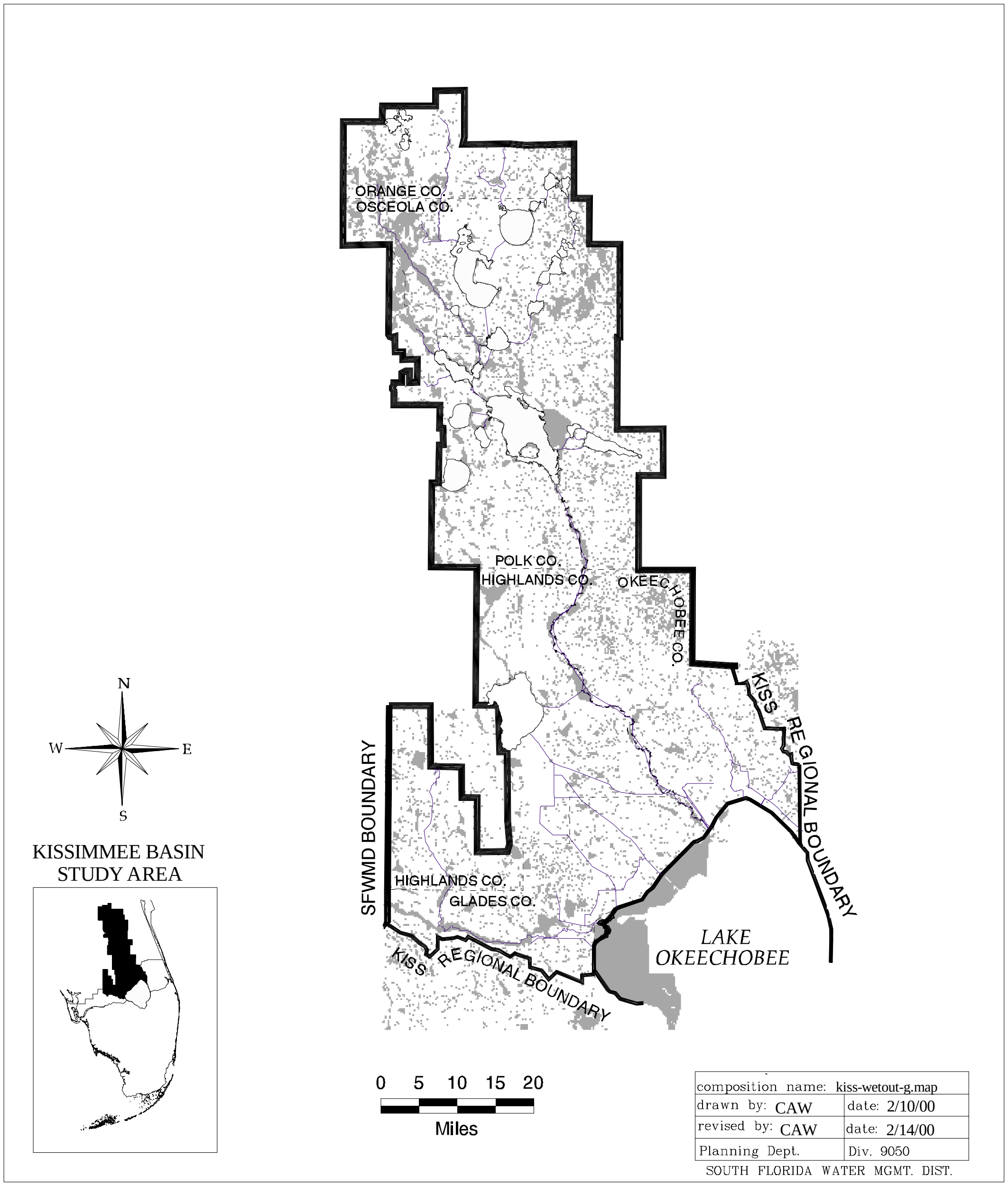

Figure J-3. Identified Wetland Systems (denoted by gray areas).

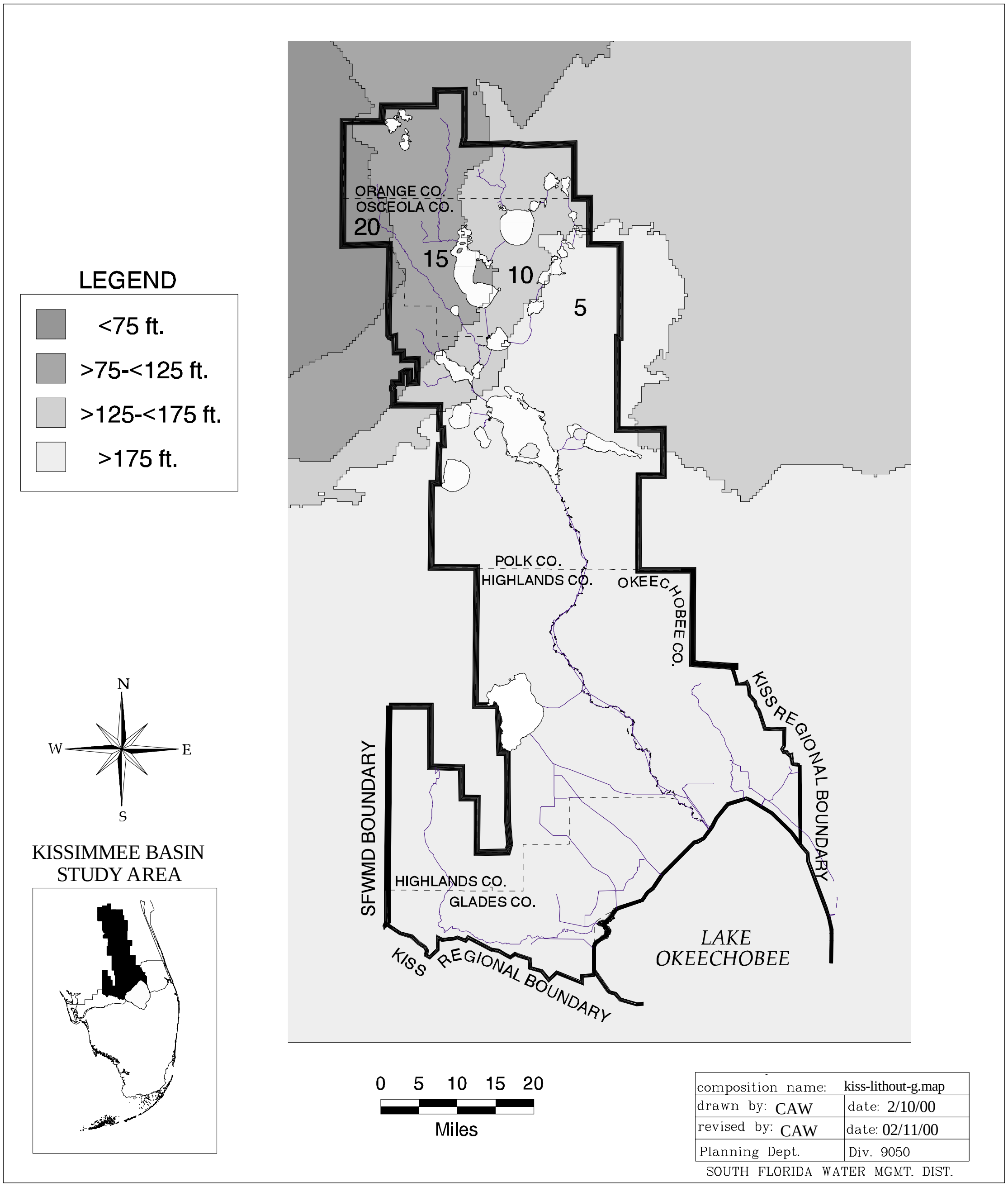

Figure J-4. Thickness Scores.

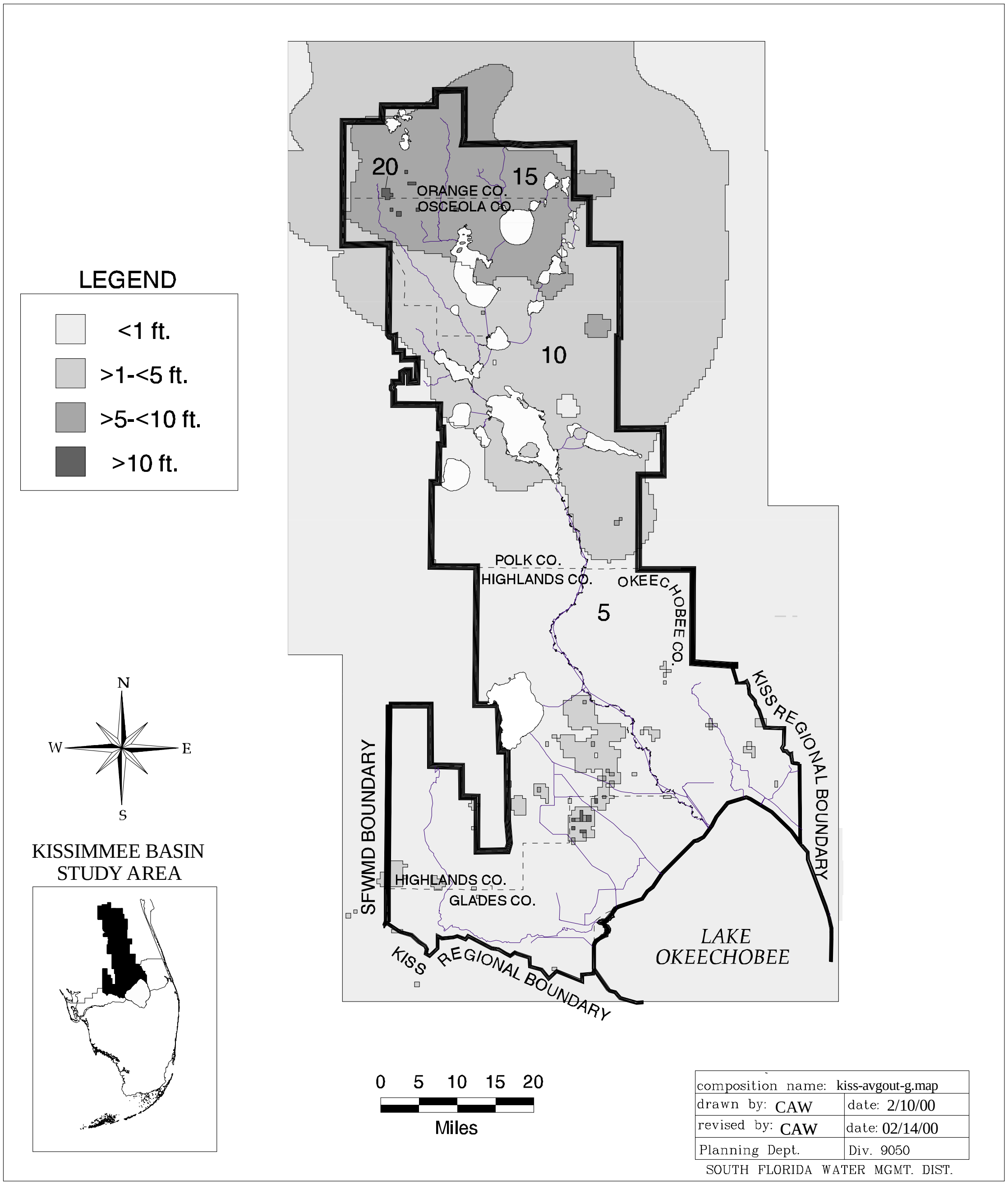

Figure J-5. Drawdown Scores.

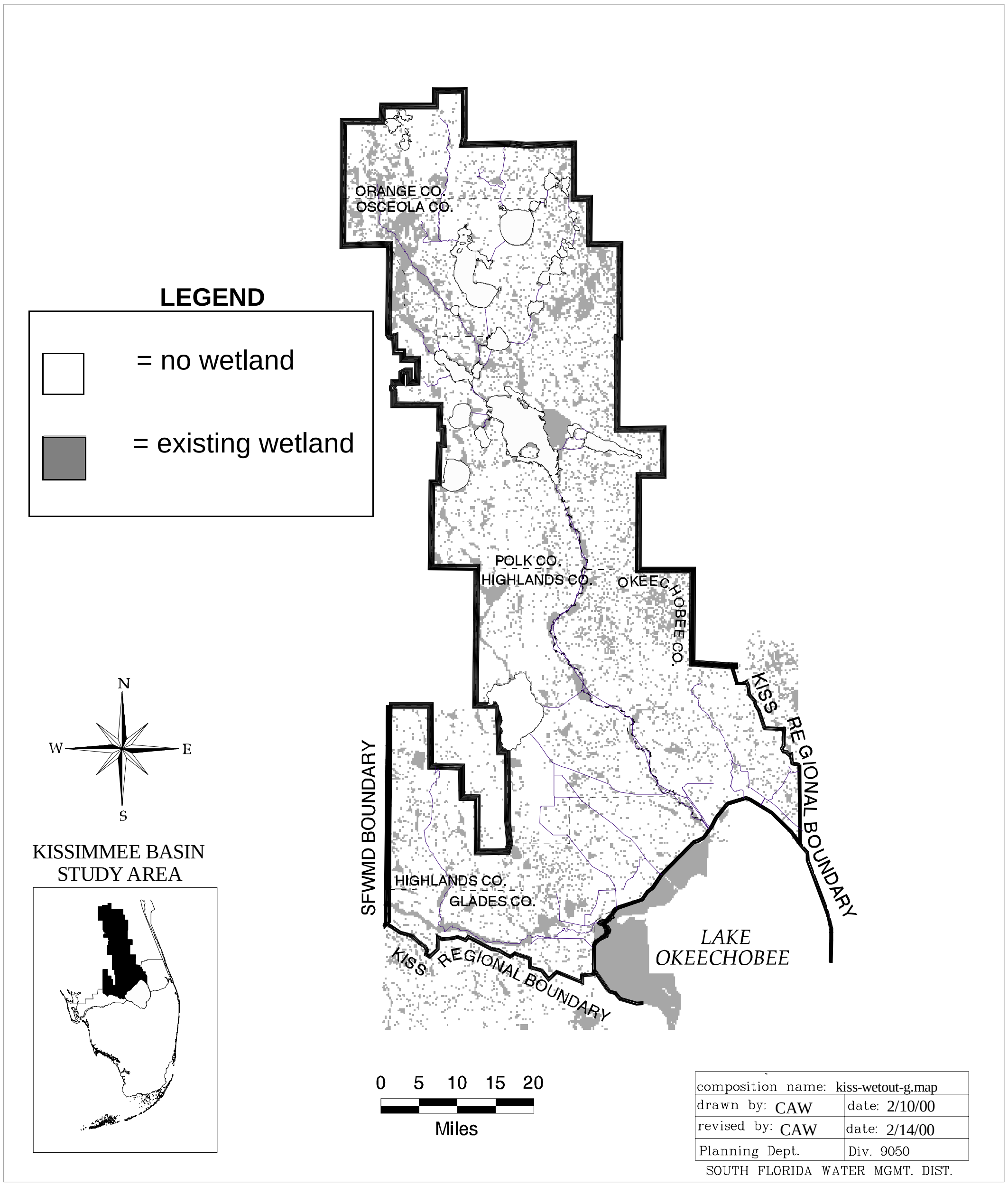

Figure J-6. Wetland Scores.

Table J-1. Variable Scoring Assignments.

Layer	Measurement	Score
Confining Unit Thickness	<75 feet	20
	>75 - <125 feet	15
	>125 - <175 feet	10
	>175 feet	5
Wetland Location	No Wetland in Cell	0
	Wetland in Cell	10
Aquifer Drawdown (2020 minus 1995)	> 10 feet	20
	> 5 - <10 feet	15
	>1 - <5 feet	10
	<1 foot	5

COMBINING OF SCORES

The weighted score for each cell for each layer was summed and divided by three to create single output layer. The resultant output layer had scores ranging from 3.3 to 16.7 points. The range of points for the output layer was divided equally into three categories identifying the high, middle and low range of vulnerability. Areas having points of 3.3 to 7 were identified as having a lower vulnerability; 8-11 points were given a vulnerability of medium; and the range of 12 to 16.7 were identified as having a higher vulnerability. **Figure J-7** shows the resultant output layer and scores.

RESULTS OF THE ANALYSIS

The purpose of this analysis was to identify areas most vulnerable to possible harm to wetland features resulting from projected drawdowns in the Floridan Aquifer System (FAS) due to changes in water use from 1995 to 2020. Areas in Southwest Orange and Northwest Osceola counties received the highest resultant score and are therefore identified as being the most vulnerable. This analysis does not predict that harm to wetlands will occur, but rather identifies areas which would have the greatest potential for harm if it were to occur as a result of projected drawdowns in the Floridan aquifer.

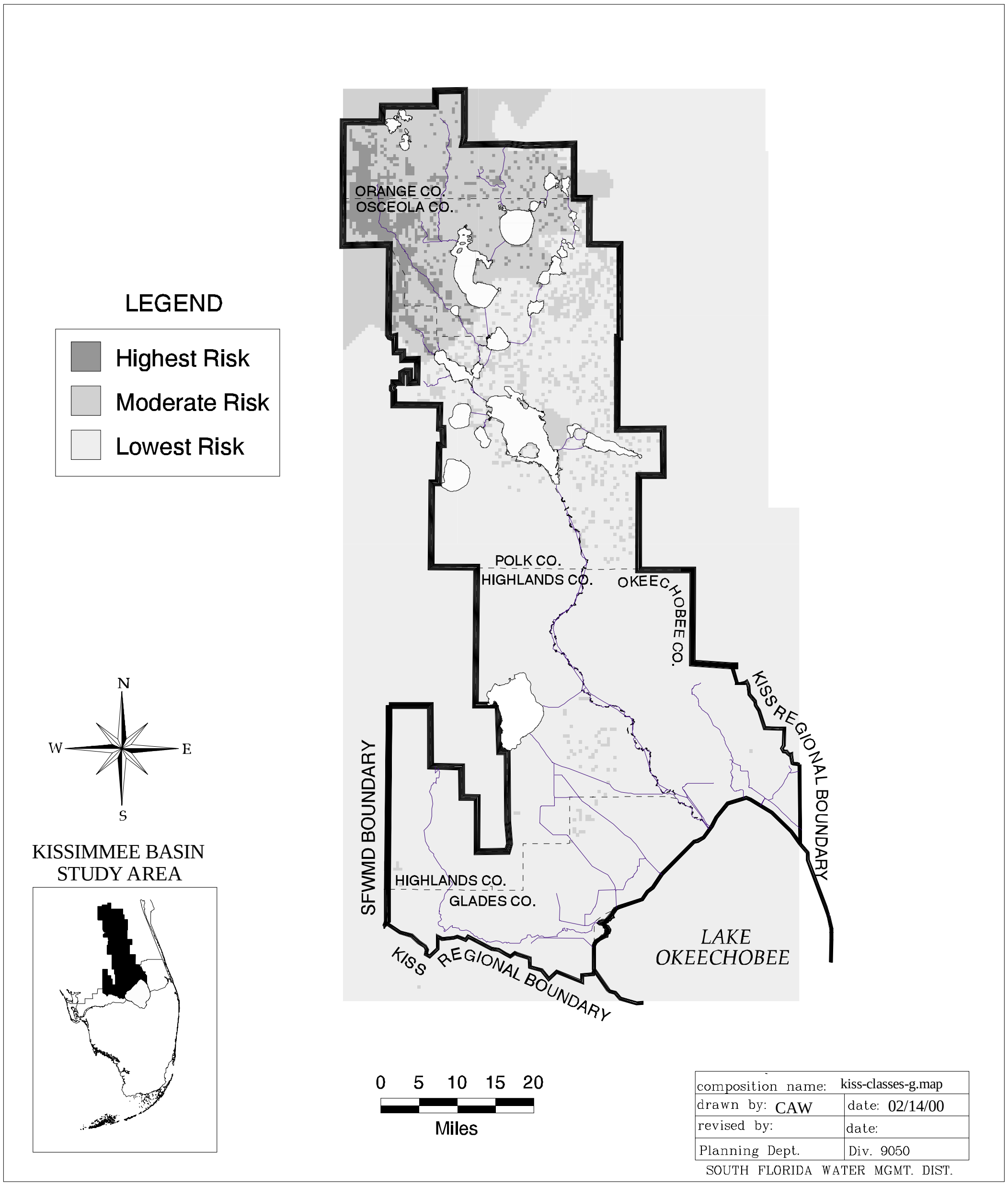

Figure J-7. Locations Vulnerable to Wetland Harm.